

What is claimed:

42. A multi-point seat belt for increasing survival chance of a passenger of a transport system in an accident or during in-flight turbulence, comprising

5 a first and second shoulder belt portion, a lap belt portion and an extending belt portion (1.1 to 1.4) and a first and second belt end (ER) and (EL), where the extending belt portion (1.4), having the second belt end (EL), loosely guided by a shoulder-belt-portion deflector (5, 5b, 12) and equipped with a belt retractor (13), having a clamping device, is attached to a stiff third transport-system member, generally representing a floor of the transport system adjacent to a second seat-side or a seat-backrest frame at the second seat-side or a post section of a motor vehicle adjacent to the second seat-side ;

10 a main buckle assembly (9.1) having a master release button (84) and attached to a stiff first transport-system member, generally representing the floor of the transport system adjacent to a first seat-side or a seat-cushion frame at the first seat-side or a mid-tunnel of a motor vehicle adjacent to the first seat-side;

15 at least two latch plates (2, 2a, 9, 11, 25), the first of which is a main latch plate (9), moveable either along the lap belt portion (1.3) or along the second shoulder belt portion (1.2), and the second of which is a shoulder latch plate (2, 2a) of the first belt end (ER) of the first shoulder belt portion (1.1);

20 a lower belt deflector (17), deflecting and loosely guiding the lap belt portion (1.3) or the first shoulder belt portion (1.1) and attached to a stiff second transport-system member, generally representing the floor of the transport system adjacent to the second seat-side or the seat-cushion frame at the second seat-side or the post section of the motor vehicle adjacent to the second seat-side or a side rail of the motor vehicle adjacent to the second seat-side; and

25 at least one upper buckle assembly (4, 4b, 4c, 4e, 14, 14a, 18, 18a, 18b, 18.1 to 18.3), located on the seat backrest at the first seat-side;

whereby

30 a lower part of the body (96) of the passenger and an upper part of the body (95) are restrained by the lap- and second shoulder belt portions (1.3, 1.2) when the main latch plate (9) is plug-in connected to the main buckle assembly (9.1); and

the upper part of the body is restrained by the first and second shoulder belt portions, both (1.1, 1.2) extending crosswise in an X-shape when the shoulder latch plate (2, 2a) is plug-in connected to the upper buckle assembly.

35 43. The multi-point seat belt according to claim 42, wherein the master release button (84), when depressed, releases all the latch plates from the respective buckle assemblies.

44. The multi-point seat belt according to claim 43, wherein the master release button (84) is provided with release cables (4.2) connecting to release buttons of the upper buckle assemblies.

40 45. The multi-point seat belt according to claim 43, wherein the master release button (84) is provided with release wires connecting to electrical release-motors (4.2b) of release buttons of the upper buckle assemblies.

46. The multi-point seat belt according to claim 42, wherein the multi-point seat belt (1, 1a to 1d) consists of a three-point seat belt (1e) and an upper first shoulder belt (1.12a), a first belt end of which and a second belt end are provided with a transition buckle assembly (4e) and the shoulder latch plate (2a), plug-in connected to the upper buckle assembly; and
5 a transition latch plate (2) is attached to a first belt end of a lower first shoulder belt portion (1.11) of the three-point seat belt (1e);

whereby

10 the passenger is restrained when the main latch plate (9) and the transition latch plate (2) are plug-in connected to the main buckle assembly (9.1) and the transition buckle assembly (4e), where the lower first shoulder belt portion (1.11) projects through the lower belt deflector (17) at a sufficient length (l_1) needed for the belt retractor to retract the first shoulder belt portion (1.1), defined by the lower first shoulder belt portion (1.11) and the upper first shoulder belt (1.12a), in the accident.

47. The multi-point seat belt according to claim 42, wherein the multi-point seat belt (1, 1a to 1d) consists of a three-point seat belt (1e) and an upper first shoulder belt (1.12),
15 a first belt end of which is provided with a transition buckle assembly (4e), having a transition release button (84c), acting as the upper buckle assembly (4) and located in a home position on a seat-backrest aperture of the seat backrest at the first seat-side, and a second belt end is arranged to the seat-backrest frame at the first seat-side; and
20 a transition latch plate (2) is attached to a first belt end of a lower first shoulder belt portion (1.11) of the three-point seat belt (1e);

whereby

25 in a coupling position the passenger is restrained when the main latch plate (9) and the transition latch plate (2) are plug-in connected to the main buckle assembly (9.1) and the transition buckle assembly (4e), pulled out from the seat-backrest aperture, wherethrough a transition portion of the upper first shoulder belt is projected, where the lower first shoulder belt portion (1.11) projects through the lower belt deflector (17) at a sufficient length (l_1) needed for the belt retractor to retract the first shoulder belt portion (1.1), defined by the lower first shoulder belt portion (1.11) and the upper first shoulder belt
30 (1.12), in the accident.

48. The multi-point seat belt according to claim 47, wherein the second belt end of the upper first shoulder belt (1.12) is provided with a second belt retractor (13a), arranged in the seat backrest (3.2) at the first seat-side, and having a spring force, which is less than that of the belt retractor (13);

35 whereby

40 in the coupling position the belt retractor pulls the upper first shoulder belt out from the second belt retractor through the seat-backrest aperture or
in the home position the transition buckle assembly (4e), released by depressing the transition release button, is pulled by the second belt retractor until being located on the seat-backrest aperture.

49. The multi-point seat belt according to claim 48, wherein the transition buckle assembly is provided with an electrical release-motor (4.2b), which, when receiving an electrical signal from the main buckle assembly resulting from depressing the main release button releasing the main latch plate, pulls the transition release button to release the transition latch plate.

50. The multi-point seat belt according to claim 42, wherein the lower belt deflector (17) comprises a housing, having an attachment hole, and a pin (17.1), attached in the housing to form an aperture which loosely retains the released shoulder latch plate (2, 2a).

51. The multi-point seat belt according to claim 50, wherein the pin (17.1) is surrounded by a sleeve (17.2).

52. The multi-point seat belt according to claim 51, wherein the lower belt deflector (17) is made from one piece.

53. The multi-point seat belt according to claim 43, wherein the released shoulder latch plate is plug-in connected to an assisting buckle assembly (16, 16a, 16b), having an easily-accessible release button and attached to a seat, where the passenger, wanting to use the multi-point seat belt, depresses the easily-accessible release button to release and access the shoulder latch plate.

54. The multi-point seat belt according to claim 43, wherein the released shoulder latch plate is plug-in connected to an assisting buckle assembly (16, 16a, 16b), having an easily-accessible release button and attached to the post section, where the passenger, wanting to use the multi-point seat belt, depresses the easily-accessible release button to release and access the shoulder latch plate.

55. The multi-point seat belt according to claim 43, wherein a belt-feeding device (20a, 20b) consists of

a belt housing (20.4a), to which the shoulder latch plate (2, 2a) of the first shoulder belt portion (1.1) is attached; and
an operating arm (20.2a), to a first end of which and a second end are connected to the belt housing and a guide tube (20.1), pivotally attached in a supporting tube of the seat backrest;

whereby the shoulder latch plate (2, 2a) is inserted into and connected to the upper buckle assembly (4, 14, 18) and the first shoulder belt portion is moved from a resting position at the second seat-side to an operative position at the first seat-side by a rotatory movement of the operating arm.

56. The multi-point seat belt according to claim 55, wherein the belt-feeding device (20a, 20b) is provided with at least one drive apparatus to rotate the operating arm, where the shoulder latch plate (2, 2a) is inserted into and connected to the upper buckle assembly (4, 14, 18) and the first shoulder belt portion is moved from the resting position at the second seat-side to the operative position at the first seat-side by a rotatory movement of the operating arm when the drive apparatus is activated.

57. The multi-point seat belt according to claim 56, wherein the operating arm (20.2a) consists of

a horizontal portion, to an end of which the guide tube is fastened; and
a vertical portion, an end of which is fastened to the belt housing, having a vertical tube with two openings, facing each other, which is moveable along the vertical portion to adjust a height of the belt housing.

58. The multi-point seat belt according to claim 57, wherein a radial-adjustable tube (20.3) is attached between the horizontal portion and the guide tube, where the first shoulder belt portion is moved from the resting position to the operative position by a radial-adjusting movement of the radial-adjustable tube when the drive apparatus is activated.

59. The multi-point seat belt according to claim 56, wherein the drive apparatus is operable to return the first shoulder belt portion (1.1) from the operative position to the resting position, when a dwell time, predetermined for inserting the main latch plate (9) into the main buckle assembly (9.1), is exceeded.

5 60. The multi-point seat belt according to claim 56, wherein the drive apparatus returns the first shoulder belt portion (1.1) from the operative position to the resting position, when a dwell time, predetermined for inserting the shoulder latch plate (2, 2a) into the upper buckle assembly (4, 4a to 4c, 14, 14a, 18), is exceeded.

10 61. The multi-point seat belt according to claim 56, wherein the drive apparatus, activated in response to activating a switch, attached in the main buckle assembly (9.1), upon contact with a cam of the main latch plate (9), when inserted therein, is switched off when the operative position is reached.

15 62. The multi-point seat belt according to claim 56, wherein the drive apparatus, activated in response to starting an engine of the transport system, is switched off when the operative position is reached.

63. The multi-point seat belt according to claim 56, wherein the drive apparatus, activated in response to closing a vehicle door of the transport system, is switched off when the operative position is reached.

20 64. The multi-point seat belt according to claim 56, wherein the drive apparatus, activated in response to actuating a switch, is switched off when the operative position is reached.

65. The multi-point seat belt according to claim 56, wherein the drive apparatus is activated when the passenger takes a seat, where to a sensor is built, where the drive apparatus is switched off when the operative position is reached.

25 66. The multi-point seat belt according to claim 56, wherein the drive apparatus, activated in response to depressing x-times the master release button (84), is switched off when the operative position is reached.

67. The multi-point seat belt according to claim 56, wherein the master release button (84) is provided with

30 release wires connecting to electrical release-motors (4.2b) of release buttons of the upper buckle assemblies and

a release wire connecting to the drive apparatus;
where the master release button, when depressed, releases all the latch plates from the respective buckle assemblies and returns the belt-feeding device to the resting position.

35 68. The multi-point seat belt according to claim 42, wherein the supplemental latch plate is a belt-detachable latch plate (25), which has a quick-release pin (25.1) and a U-shaped portion to house the belt portion of the seat belt which is secured therein by the quick-release pin and detached therefrom by pulling it.

40 69. The multi-point seat belt according to claim 68, wherein the seat backrest at the second seat-side is provided with supplemental upper buckle assemblies (19, 19a, 19b, 19.1 to 19.3), which together with the corresponding supplemental upper buckle assemblies at the first seat-side define the pairs of supplemental upper buckle assemblies (18 / 19, 18a / 19a, 18b / 19b, 18.1 / 19.1 to 18.3 / 19.3),

one of which is adapted to a small body proportion of the passenger, lower than the upper buckle assembly; and, finally, the belt-detachable latch plates, housing both shoulder belt portions, are plug-in connected to that pair.

5 70. The multi-point seat belt according to claim 69, wherein the belt-detachable latch plates, when not being used, are stored and secured in a storage box (25.5) of the seat.

71. The multi-point seat belt according to claim 69, wherein the buckle assembly is provided with a coupling fitting (1.2a, 1.2b) to receive energy absorbers.

10 72. The multi-point seat belt according to claim 56, wherein a belt-catching member (20.7, 20.7a) is attached to the seat backrest to intercept and hold at least one shoulder belt portion when being in the resting position.

73. The multi-point seat belt according to claim 43, further comprising a height- and width-adjusting mechanism (27) consisting of

15 a pair of tubes (27.1) of a seat backrest frame (3.4d) having a plurality of vertical locking slots, one pair of which is engaged with a locking handle (27.5), that is pulled to detach therefrom and released to engage with another pair, when adjusting to a height of a body proportion of the passenger;

20 a frame (29) consisting of a pair of outer frame-tubes (27.2), moveable along the inner frame-tubes (27.1), a connecting member of all frame-tubes (27.2, 27.3) and a pair of outer tubes (27.3), in which inner tubes (27.4) are moveable, biased by tube-springs (27.6) and form- and force-locking connected to the locking handle (27.5), where the tube-spring (27.6) on a sleeve (27.7), secured by a pin (27.8), protruding through holes of the inner tube (27.4), presses against a spring rest (27.9 of the outer tube (27.3);

25 a plurality of horizontal locking slots arranged along one of the outer tubes (27.3); and at least one buckle-assembly unit (18.3, 19.3), consisting of an upper buckle assembly (4c), to connect to the shoulder latch plate, and a housing (18.12), form-locking connected to the upper buckle assembly, moveable along the outer tubes (27.3) and secured by a pawl (18.10) biased by a pawl-spring (18.5), engaged with the horizontal locking slot (r) and detached therefrom by pulling the pawl to adjust to a width of the body proportion.

30 74. A shoulder-belt-portion deflecting device for more convenience and increased survival chance of a passenger of a transport system in an accident or during an in-flight turbulence, comprising a height-adjustable shoulder-belt-portion deflector (5, 5a, 5b), serving as a member of a head rest (3.6, 3.6a) of a seat of the transport system, where the shoulder-belt-portion deflector (5, 5a, 5b), when adjusted to a body proportion of the passenger, restrained
35 by a seat belt (1, 1a to 1e),

loosely guides a shoulder belt portion (1.2) of a seat belt (1, 1e), which downwardly extends over a shoulder and an upper part of the body of the belted passenger; and prevents neck-injury in the accident or during the in-flight turbulence.

40 75. The shoulder-belt-portion guiding device according to claim 74, wherein the head rest (3.6a) is height-adjustable and has the shoulder-belt-portion deflector (5a) and at least two stiff head-rest tubes, moveable along members of a seat-backrest frame, guided thereby and locked therein, where the head rest (3.6a) is adjusted to a height of a head of the passenger, thus resulting in a self-adaptation of the shoulder-belt-portion deflector (5a) with the shoulder belt portion (1.2) to the body proportion of the passenger.

76. The shoulder-belt-portion guiding device according to claim 74, wherein the shoulder-belt-portion deflector (5, 5b), guided by a member of a seat-backrest frame, movable therealong and nonrotating about a longitudinal axis thereof, has
an upper portion, projected through a top edge of the seat backrest and provided with an
aperture (5.9), loosely guiding the shoulder belt portion; and
a locking handle (5.2), having a locking member, which, when unlocked, allows the aperture
(5.9) with the shoulder belt portion (1.2) to be adapted to the body proportion of the
passenger.

77. The shoulder-belt-portion guiding device according to claim 76, wherein the head rest (3.6a) is fastened to a free-end of the upper portion of the nonrotating shoulder-belt-portion deflector (5, 5b), serving as a single head-rest tube, where the head rest (3.6a) is adjusted to a height of a head of the passenger, thus resulting in a self-adaptation of the shoulder-belt-portion deflector (5, 5b) with the shoulder belt portion (1.2) to the body proportion of the passenger.

78. An anti-submarining seat-belt assembly for increasing survival chance of a passenger of a transport system in an accident or during in-flight turbulence, comprising
a seat belt, consisting of at least one shoulder belt portion (1.1, 1.2), a lap belt portion (1.3) and an extending belt portion (1.4);
a main buckle assembly (9.1), having a master release button (84) and attached to a stiff first transport-system member, generally representing a floor of the transport system adjacent to a first seat-side or a seat-cushion frame at the first seat-side or a mid-tunnel of a motor vehicle adjacent to the first seat-side;
a lower belt deflector (17), deflecting and loosely guiding the lap belt portion (1.3) or the shoulder belt portion (1.1) and attached to a stiff second transport-system member, generally representing the floor of the transport system adjacent to a second seat-side or the seat-cushion frame at the second seat-side or a post section of the motor vehicle adjacent to the second seat-side or a side rail of the motor vehicle adjacent to the second seat-side;
at least two latch plates (9, 11, 25), the first of which is a main latch plate (9), moveable either along the lap belt portion or along the second shoulder belt portion, and the second of which is an anti-submarining latch plate (11, 25), moveable along the lap belt portion; and
anti-submarining buckle assemblies, attached to a seat frame of a seat, generally representing the seat-cushion frame or a seat-backrest frame;
whereby
a lower part of the body (96) of the passenger and an upper part of the body (95) are restrained by the lap- and shoulder belt portions when the main latch plate (9) is plug-in connected to the main buckle assembly (9.1); and
the lap belt portion (1.3) is subdivided into two anti-submarining belt portions (1.3R, 1.3L) to restrain thighs of the passenger when the anti-submarining latch plate is plug-in connected to one of the anti-submarining buckle assemblies.

79. The anti-submarining seat-belt assembly according to claim 78, wherein the anti-submarining buckle assemblies (7, 8, 8a) have housings, located in the seat cushion (3.1, 3.1a to 3.1d), and a common release button (84o), located on the seat, where the common release button, when depressed, releases the anti-submarining latch plate.

80. The anti-submarining seat-belt assembly according to claim **79**, wherein the common release button (**84o**) is provided with release cables (**4.2**) connecting to release buttons (**84a**) of the anti-submarining buckle assemblies.

81. The anti-submarining seat-belt assembly according to claim **79**, wherein the common release button (**84o**) is provided with release wires connecting to electrical release-motors (**4.2b**) of release buttons (**84b**) of the anti-submarining buckle assemblies.

82. The anti-submarining seat-belt assembly according to claim **78**, wherein the master release button (**84**), when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies.

83. The anti-submarining seat-belt assembly according to claim **82**, wherein the master release button (**84**) is provided with release cables (**4.2**) connecting to release buttons of the anti-submarining buckle assemblies.

84. The anti-submarining seat-belt assembly according to claim **78**, wherein the master release button (**84**), when depressed, releases the main latch plate and the anti-submarining latch plate from the respective buckle assemblies and returns a belt-feeding device from an operative position to a resting position.

85. The anti-submarining seat-belt assembly according to claim **84**, wherein the master release button (**84**) is provided with release wires connecting to electrical release-motors (**4.2b**) of release buttons of the anti-submarining buckle assemblies and a release wire connecting to a drive apparatus of the belt-feeding device.

86. The anti-submarining seat-belt assembly according to claim **78**, wherein the free-moving anti-submarining buckle assembly (**8b**, **8c**) has a housing, free-moving on the seat cushion and provided with a release button (**84e**, **84f**), and a length-adjustable belt, attached to the seat frame.

87. The anti-submarining seat-belt assembly according to claim **78**, wherein the anti-submarining buckle assembly (**8d**) has a housing, located on the seat cushion (**3.1**, **3.1a** to **3.1d**) and provided with a release button (**84d**), which, when depressed, releases the anti-submarining latch plate.

88. The anti-submarining seat-belt assembly according to claim **78**, wherein the supplement anti-submarining latch plate is a belt-detachable latch plate (**25**), having a quick-release pin (**25.1**) and a U-shaped portion to house the lap belt portion which is secured therein by the quick-release pin and detached therefrom by pulling it.

89. The anti-submarining seat-belt assembly according to claim **88**, wherein the anti-submarining belt portions are provided with at least one pair of belt-detachable latch plates, which are plug-in connected to the anti-submarining buckle assemblies in the seat cushion at the first and second seat-side to properly restrain the thighs with small circumference.

90. The anti-submarining seat-belt assembly according to claim **89**, wherein the belt-detachable latch plates, when not being used, are stored and secured in a storage box (**25.5**) of the seat.